(12) UK Patent Application (19) GB (11) 2 064 402 A

(21) Application No 7942505
(22) Date of filing 10 Dec 1979
(43) Application published
17 Jun 1981
(51) INT CL³
B21D 28/26
(52) Domestic classification
B3W 10L20U 10LY 11K
27 9A20U 9AY
B3E 10F 14J 1EX 1Y LB
B4B 11B1 16G7 16J
(56) Documents cited
GB 1548730
GB 724588
GB 621677
(58) Field of search
B3W
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(54) A Machine Tool

(57) A machine tool for use in the manufacture of components from a strip (4) of sheet material comprises means (3) for driving the strip (4) through the machine at a predetermined rate and for halting the strip (4) when a portion of the strip (4) reaches a predetermined position within the machine. At least one tool (2) is provided in the machine for performing an operation on the stationary portion of the strip (4). The tool (2) is movable in first and second perpendicular directions which are parallel with the plane containing the area of the strip (4) for operation on by the tool (2). Means (5) are also provided for severing a piece of strip (4) of a predetermined size from the end of the strip (4) after it has been operated on by the tool (2) to produce a sheet metal component. Punching, nibbling and bending tools 2a—d are adjustable under control of a computer 6 by a longitudinal screw 11 and lateral screws 17.

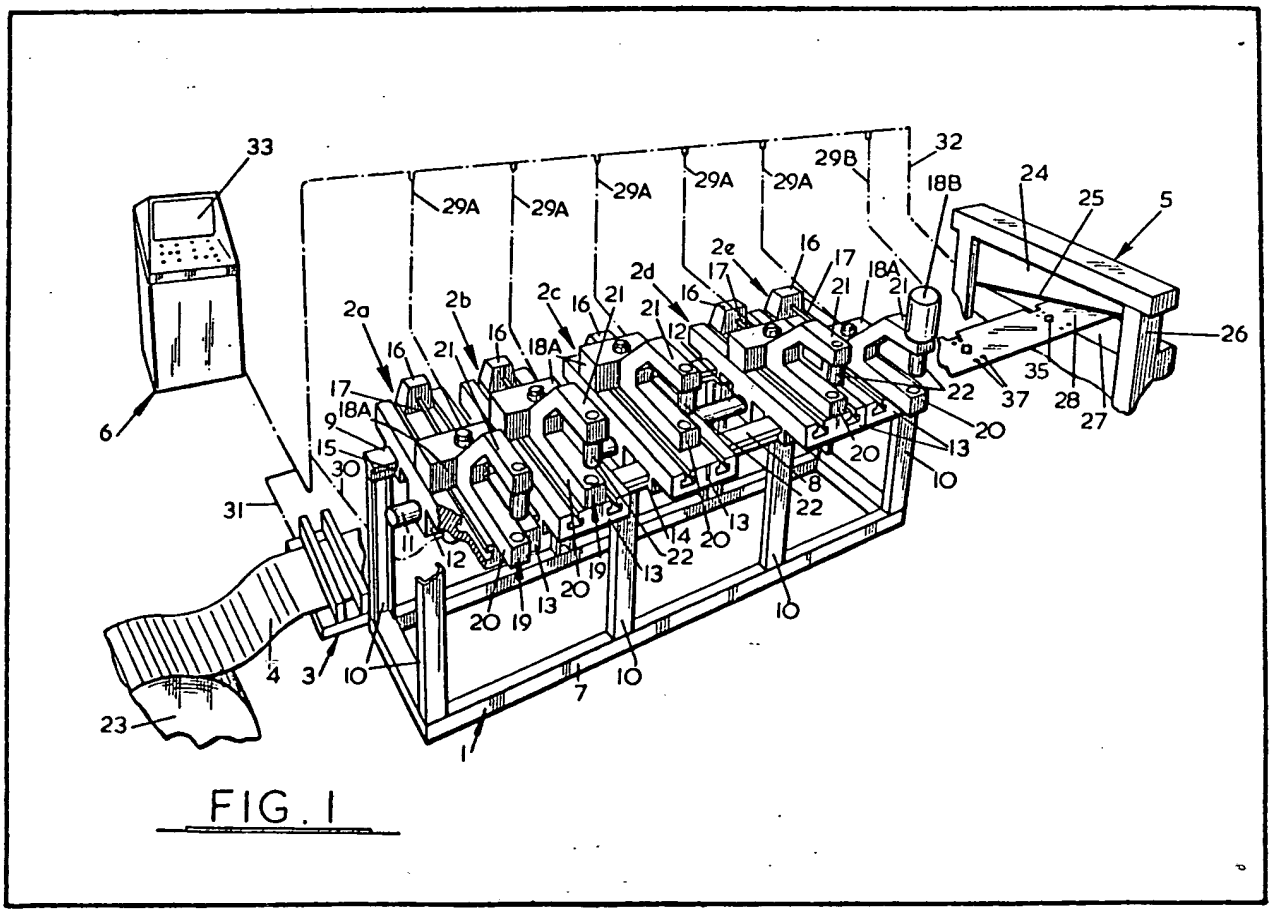

FIG. 1

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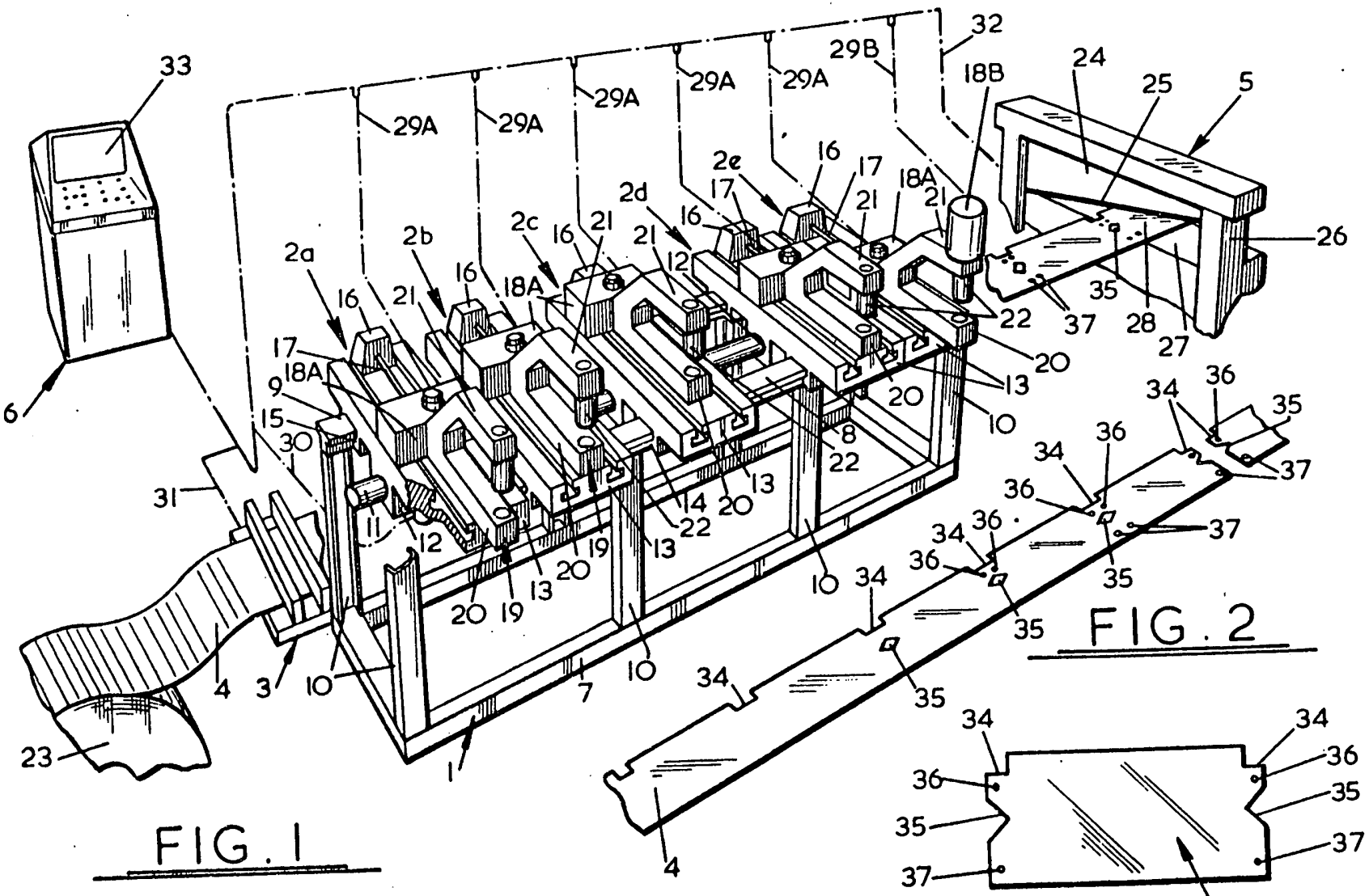

FIG. 1

FIG. 2

FIG. 3

SPECIFICATION
A Machine Tool

The present invention relates to a machine tool for use in the manufacture of components from sheet material.

Most industrial sheet metal components are currently produced by presses which have been fitted with purpose-designed tooling whereby each component is individually pressed out in a completed or partially completed form from a cut blank or strip of sheet metal. When it is desired to alter details of the component it is a major and expensive operation to alter the tooling. Although it has been found possible to produce a press wherein each component of the tooling is individually mounted on a template so that each component can be changed individually, the initial cost of setting up such a press is high and the setting up process is difficult and lengthy.

The object of the present invention is to provide a machine tool for use in the manufacture of components from sheet material, particularly sheet metal components, which overcomes the aforementioned disadvantages.

According to the present invention there is provided a machine tool for use in the manufacture of components from a strip of sheet material comprising means for driving a strip of sheet material through the machine at a predetermined rate, means for halting the strip when a portion of the strip reaches a predetermined position within the machine, a tool for performing an operation on the stationary portion of the strip, which tool is movable in first and second perpendicular directions both parallel with the plane containing the area of the strip for operation on by the tool, and means for detaching a piece of a predetermined size from the end of the strip after it has been operated on by the tool to produce the sheet metal component.

Preferably, the machine comprises a plurality of said tools which are individually and successively operable whereby a plurality of operations can be successively performed on said portion of the strip as it passes through the machine.

Preferably also, the operation of said tools is controlled by a computer which is programmed according to the shape and size of the components it is desired to produce.

Preferably also, the position of each of said tools and the operation of the driving means, halting means and detachment means is also controlled by the computer.

The present invention will now be described by way of example with reference to the accompanying drawing in which:—

Fig. 1 is a schematic perspective view of a machine tool according to the present invention;

Fig. 2 is a perspective view of a strip of sheet metal showing the results of successive operations of the tools of the machine shown in Fig. 1 as the strip passes through the machine; and

Fig. 3 is an elevation of the sheet metal component produced by the machine shown in Fig. 1 from the strip shown in Fig. 2.

Referring firstly to Fig. 1, the machine tool comprises a framework 1 on which is mounted a plurality of tool units 2, independently labelled 2*a*, 2*b*, 2*c*, 2*d*, 2*e*, and which is combined with a means 3 for driving a strip 4 of sheet metal through the machine together with a cutting means 5 for detaching pieces from one end of the strip 4. The operation of each of the tool units 2, driving means 3, and the cutting means 5 is controlled by a computer 6 which is programmed according to the component it is desired to produce and to which each of these machine components is linked.

The framework 1 comprises a rectangular frame 7 which supports a pair of parallel horizontal rails 8, 9 by means of upright members 10. The rails 8, 9 are located at the same horizontal level and each of the tool units 2 is mounted to ride on both rails 8, 9 so that the tool units 2 can be moved individually horizontally along the framework 1 and located in a desired position. The tool units 2 are also connected together by a horizontal screwed bar 11 which passes through a bore provided in a depending portion 12 of each tool unit 2 which is located between the rails 8 and 9. Clamping means (not shown) are provided for each tool unit 2 whereby the latter can be releasably locked in position on the bar 11 relative to the rails 8 and 9 in the aforesaid desired position.

Each of the tool units 2 comprises a block 13 which is provided with a pair of keyways 14, 15, by which the tool unit 2 is mounted on the rails 8, 9 respectively, and with the portion 12 defining the bore for passage of the screwed bar 11. Located on the upper part of the block 13 by means of a support member 16 is a horizontal screwed rod 17 which is perpendicular to the bar 11 and the rails 8, and 9. A power unit 18A attached to a tool head arrangement 19 is attached to and movable along the screwed rod 17 so that the unit 18A and the arrangement 19 can travel over the block 13. The power unit 18A powers the movement of the arrangement 19 along the rod 17. Each block 13 is, in addition, provided with a second power unit located within the portion 12 whereby movement of the tool unit 2 along the bar 11 can be powered.

The tool head arrangement 19 of each tool unit 2 comprises a bar 20, over which the strip 4 to be operated on passes and an overhead arm 21, which carries a tool head 22. The tool heads 22 carry individually mounted tools (not shown) which can be replaced and that one of a variety of tools can be attached to each tool head 22 according to the operation it is desired to carry out. Such operations may include punching, notching, nibbling or forming, the last operation involving the folding of the edges of the strip or slight relieving of the strip, for example. The tool heads 22 are powered by power units 18B mounted on the arms 22, only one unit 18B to

power tool unit 2*e* being shown in Fig. 1 for clarity.

Sheet metal to be worked into the required component is fed into the machine at one end of the framework 1 in strip form as at 4 from a roll 23. The strip 4 passes substantially horizontally over each of the bars 20 of the tool units 2, which are located at the same horizontal level and is driven through the machine by the driving means 3 which also comprises a means of halting the strip 4 at any predetermined position within the machine. The means 3 can operate in any known manner provided that the rate at which the strip 4 is fed into the machine is strictly controlled or a sensor is incorporated therewith so that the position of the strip 4 at any instant within the machine is known. In addition a plurality of means 3 may be provided interspersed between the tool units 2 to drive the end of the strip 4 through the machine.

Located at the opposite end of the framework 1 from the driving means 3 are the means 5 which comprise a guillotine having a blade 24 with an oblique cutting edge 25. The blade 24 is located in a frame 26 which is provided with a table 27 against which the end 28 of the strip 4 can rest whilst it is being cut and detached from the rest of the strip 4.

The operation of the machine is controlled by the computer which is programmed according to the shape and size of the component to be made and which is connected to each of the control units 18A by leads 29A and to the control units 18B by leads 29B, to each of the second control units located in the portions 12 by leads 30, to the driving means 3 by a lead 31, and to the cutting means 5 by a lead 32. The computer 6 can be programmed so that it indicates by means of a visual display screen 33 the appropriate tool for each of the tool heads 22 and so that the position of each of the tool units 2 and the tool heads 22 on the tool units 2 is automatically controlled. Each tool head 22 is then controlled in operation sequentially so that the appropriate operations are carried out on the strip 4 as it passes through the machine and the cutting means 5 are controlled to cut off appropriately sized pieces from the end 27 of the strip 4 at the appropriate place to produce a component of the required shape.

Fig. 2 shows the successive operations which can be carried out on a strip 4 as it progresses through the machine to produce the component shown in Fig. 3. Firstly, a rectangular notch 34 is cut in the edge of the strip 4. This notch 34 could be stamped out in one operation or could be nibbled away in a plurality of operations until the notch is of the required size. These operations would only require a single tool 2. However, in the present example, the notch 34 is cut by the first two tool units 2*a*, 2*b* each of which nibbles away a rectangular notch of half the width of the notch 34 required, the second tool unit 2*b* operating within the notch cut by the first tool unit 2*a*. The third tool unit 2*c* stamps out a diamond-shaped aperture 35 in the strip 4 adjacent the notch 34. The two last tool units 2*d* and 2*e* each stamp out a pair of holes in two successive operations. The fourth tool unit 2*d* stamps out holes 36 between the notch 34 and th aperture 35 and the fifth tool unit 2*e* stamps out holes 37 between the aperture 35 and the adjacent edge of the strip 4. Once these operations have been accomplished the strip 4 proceeds to the cutting means 5 where the strip is cut in one cutting operation symmetrically between each of the pairs of holes 36 and 37 and through the aperture 35 and the notch 34. A plurality of blanks 38 as shown in Fig. 3 are thereby produced after the aforementioned operations of the machine have been carried out.

It will be appreciated that the computer 6 can be programmed to produce the desired components in the shortest possible time by operating the tool units 2, in an optimum sequence. For example, with reference to Figs. 2 and 3, it can be seen that the first two tools can both operate at exactly the same time for the same length of time as the strip 4 must be driven by the driving means 3 for the same distance through the machine before each successive operation of the tool units 2*a* and 2*b*. Likewise, during operation of the tool units 2*a* and 2*b*, the tool unit 2*c* must operate only once and the tool units 2*d* and 2*e* twice. Operation of these tool units 2*c*, 2*d*, 2*e* can be controlled to operate at the appropriate time during operation of the tool units 2*a* and 2*b* to position the aperture 34 and pairs of holes 35, 36 correctly. Apart from the actual control of the machine, the computer 6 can be linked to other machines within a factory so that the machine is operated only when required to produce the requisite number of components and may be used to produce a plurality of different components, if necessary, the position of the tool heads 22 being varied as required under control of the computer 6.

Great flexibility of operation is possible by controlling the machine by the computer 6 and the latter can be used to indicate the appropriate tools required for each tool head 22, the number of components produced and to stop operation of the machine if there is a failure of any part thereof. In addition, the computer 6 can be linked to a main frame computer from which instructions can be sent to the computer 6 to control, for example, the number and type of components produced.

While in the present example the machine has been described with regard to the production of sheet metal components, it will be appreciated that the machine can be used to produce components of any sheet material, for example such as plastics material or cardboard, provided these can be produced from a strip of the material. The machine can accommodate various widths of strip and can be linked to other machines so that, for example, a cardboard blank could proceed directly from the machine to a second machine where it may be erected into a box. In addition, the machine can be operated other

than by the computer 6 and may be provided with any number of tool units 2 according to the operation it is desired to perform.

Claims

1. A machine tool for use in the manufacture of components from a strip of sheet material comprising means for driving a strip of sheet material through the machine at a predetermined rate, means for halting the strip when a portion of the strip reaches a predetermined position within the machine, a tool for performing an operation on the stationary portion of the strip, which tool is movable in first and second perpendicular directions both parallel with the plane containing the area of the strip for operation on by the tool, and means for detaching a piece of a predetermined size from the end of the strip after it has been operated on by the tool to produce the sheet metal component.

2. A machine tool as claimed in claim 1, which comprises a plurality of said tools which are individually and successively operable whereby a plurality of operations can be successively performed on said portion of the strip as it passes through the machine.

3. A machine tool as claimed in claim 2, in which the tools are movable in first and second perpendicular directions both within a substantially horizontal plane.

4. A machine tool as claimed in claim 2 or 3, in which the operation of said tools is controlled by a computer which is programmed according to the shape and size of the components it is desired to produce.

5. A machine tool as claimed in claim 4, in which the position of each of said tools and the operation of the driving means, halting means and detachment means is also controlled by the computer.

6. A machine tool as claimed in claim 4 or 5, in which the computer has a visual display unit on which the appropriate tools for the machine and their relative positions therein can be displayed.

7. A machine tool as claimed in any one of claims 1 to 6, in which the detachment means comprises a guillotine.

8. A machine tool for use in the manufacture of components from a strip of sheet material substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.